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## Conservation Corner

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## (Conference continued)

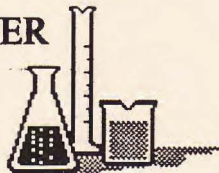
asm about underwater archaeology demonstrated by sport divers at this conference and hope that this might be an annual occasion for us to get together and dive into local history!

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## CONSERVATION CORNER

By

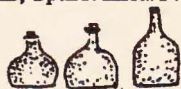
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S.C.I.A.A. Conservator



This is the first in a series of articles designed to aid Licensed Sport Divers in conserving recovered artifacts. Questions and specific problems faced by the South Carolina sport diving community are highlighted and, hopefully, answered. To this end, please telephone or mail your conservation questions to me at the Institute. You may be our next featured article! Please be sure to include your current Sport Diver's License Number, as access to a professional conservator is just one of the many benefits of membership in the State program.

Effective conservation is not as easy as many "old salts" think. "Recipe book" approaches are often outdated, physically dangerous and fail to protect the artifact. Each artifact is unique in its physical make up, depositional history, conservation requirements and final deposition (e.g., mantle place or museum). All these factors must be taken into account before an effective conservation regimen can be implemented. Nonetheless, there are broad areas of treatment that can be matched to specific classes of artifacts (e.g., iron, non-ferrous metals, woods, glass), and this column will present this basic information to give all of us in the Licensed Sport Diving community a solid foundation from which to grow. All that having been said, let's get to our first case.

### David M. Elkins, Sp.Div.Lic.#1446: Glass Bottles



David called the other day and talked with Lynn Harris about the care, cleaning and conservation of some glass bottles that he and a friend had recovered and might display at a local museum. WAY TO GO DAVE! I am always pleased when the informed public gets involved with their local museums and displays artifacts legally collected and reported through South Carolina's programs. The following discussion of glass does get a little involved, but hang in there!

#### Glass: Structure and Chemical Deterioration

Glass is unique in that it is not a solid, but a super-cooled liquid. Those of us that live in older homes are reminded of this every time we look out an original window and see the "flow" lines caused by sagging glass. Silica and boric oxides usually make up the structure of glass and are acidic. Aluminum, calcium, copper, lead, manganese and zinc oxides are also found in glass depending on the time period, color, technique and place of manufacture. The materials are primarily basic and are not tightly bonded to the acid network allowing them to be somewhat mobile. This mobility of some of the basic particles has been linked to glass deterioration, but the actual mechanism is not yet

fully understood.

In a marine environment, sodium and potassium ions may move to the surface of the glass and react with the seawater to form hydroxides. This is especially true if the quantity of aluminum, calcium and magnesium ions in the glass are insufficient to "hold" these other ions within the structure. The resulting hydroxides enter the glass, interact with the silica and form the flaking, multi-hued deteriorated glass with which we are all familiar. Pressure, temperature, length of exposure and environmental acidity are all critical factors in determining the extent of deterioration. Whenever possible, the artifact collector should make note of these factors for the conservator. Glass recovered from marine environments often continues to degrade after removal from the sea, which makes conservation of all such glass mandatory.

#### Glass: Cleaning and Conservation

Marine glass is almost never found in a clean condition. Concretions, stains and softer biotic growths or slimes are common. The actual treatment for these situations depends on the accurate identification of the organisms or materials involved and on the assessment of the condition of the artifact. Glass artifacts that are greatly deteriorated require complex and careful procedures. It is best not to attempt their conservation yourself, but to contact a competent professional instead. This includes the reconstruction of fragmented glass artifacts that will not be discussed in this article. Assuming that the glass artifact is intact and only lightly deteriorated the following procedures can be used.

Marine concretions found on the surface can often be removed by the careful use of a scalpel. It is important that the glass artifact soak for several days or weeks in distilled water, changed every other day, prior to attempting to remove the concretions. The actual length of time that the artifact soaks in distilled water depends on the quantity and size of the concretions. Gentle prying at the edge of a concretion determines if the artifact has soaked enough. Force should not be necessary for the removal of a well soaked concretion. In addition, soaking the artifact removes salts that can cause damage to glass if they are allowed to recrystallize under the surface "scales" during drying. It is usually a good practice to soak all glass artifacts. A plastic five gallon pail will usually provide sufficient room for soaking glass artifacts. Never use metal, ceramic or other hard surfaced containers, as they are likely to accidentally damage the glass.

If the marine concretions are numerous and dense, they may be removed by soaking the artifact in a 10% solution by volume of hydrochloric acid in distilled water. **Never add water to concentrated acids, always add the acid to the water. Failure to follow this step can result in severe harm..** A 10% solution by volume requires careful measuring of the materials. Hobby stores, local chemical apparatus stores and a variety of catalog vendors (e.g., Fisher Scientific, Atlanta, Georgia, or Baxter Scientific, Stone Mountain, Georgia) all carry graduated beakers and pyrex laboratory containers for measuring and mixing chemicals. Invest a little money to buy the best, it's not only safer but in the long run cheaper. The stores will often also carry the chemicals you will need. Try to buy the smallest quantity of chemicals to get the job done, you should never hoard chemicals. An ideal 10% solution equals 9 parts water to 1 part of the other chemical, in this case acid. If you were to use an 100 milliliter (ml) graduated beaker, 10 milliliters (ml) of acid would be added to 90 milliliters (ml) of distilled water. If you need to make larger quantities double the amounts (e.g., 20 ml acid in 180 ml distilled water). Be sure to fully immerse the artifact in the acid-water solution, and add more solution after the "fizzing" stops until all the concretion is removed. This bath will also remove metal ions that may have caused "stains." All acid



baths require careful monitoring, protective safety gear (i.e., rubber gloves, eye goggles, face shields and acid resistant aprons), adequate ventilation and proper disposal of depleted solutions. Serious injury can occur from improper handling and disposal. A common laboratory adage is, "if in doubt, do without." If you are unsure of a procedure or cannot safely comply with its procedural requirements do not do it. You should request assistance from a professional.

Marine concretions may remain after the above treatment if the glass has deteriorated sufficiently for serious layering to occur. Gentle acid cleaning for prolonged periods using either a 1% solution by volume of hydrochloric acid and distilled water, a 5% by weight solution of the disodium salt of ethylene diamine tetraacetic acid (EDTA) in distilled water, or a 10% solution by weight of sodium hexametaphosphate in distilled water will often rectify the problem. As before, careful measuring is the key, buy or otherwise gain access to an accurate laboratory scale. The same stores already listed will have this item and most likely the chemicals as well (or be able to order them). A 1 or 5% solution by weight is similar to the 10% solution by volume, except that the weights of the materials are the concern. Measure the weight of your distilled water necessary to cover the artifact and determine the corresponding number of grams necessary to equal the desired percentage for the solution (100 grams of water requires 1 gram of chemical or 5 grams of chemical to make a 1% or 5% solution respectively). All the safety precautions listed above apply to the use of these solutions as well.

If stains remain after the cleaning by mechanical and chemical means already discussed, a prolonged soak in a 10 or 20 volume concentration of hydrogen peroxide will usually work. The hydrogen peroxide works by bleaching the stain, making it less noticeable. These volume concentrations are commercially available from pharmaceutical and chemical suppliers.

After all the concretions, stains and slimes have been removed, the glass must be soaked again in distilled water for several days to remove traces of the chemicals. Make sure that you change the baths every other day. You will know that you have removed the chemicals when the pH of the distilled water equals the pH of the artifact bath after it has been used to soak the artifact for 24 hours. A multi-indicating litmus paper, available from the above mentioned suppliers, is an inexpensive means of determining this point.

The final step of the process is the consolidation of the glass surface. If the glass has no chatoyance (the rainbow like hue of hydrated glass) after slow drying, you will probably not need to consolidate the surface of the glass. Although, you will need to carefully monitor the glass for later problems. It is usually a very good idea to have a series of slides or color photographs that clearly show what the artifact looked like prior to conservation and immediately after it. These act as aids in determining stability later on.

If the surface is chatoyant, has definite flaking or visible lamellae (thin or thick layers of glass that follow contours but do not seem to be connected to each other), then you will need to consolidate the surface. Two different chemical consolidants have been used for this purpose, polyvinyl acetate (PVA) and Acraloid/Paraloid B-72. PVA should not be used today as it tends to contract when drying, which may cause fractures, and yellows with age. In addition, under no circumstances should Elmer's Glue (a proprietary form of PVA) be used to coat glass artifacts as it adds irreversibility to the disadvantages already listed.

Acraloid/Paraloid B-72 is a form of ethyl methacrylate copolymer and is presently the most common surface consolidant used for glass artifacts. It is usually applied in the form of a 5 - 20% solution

by volume in toluene, depending on the specific needs of the artifact. A 5% solution is the most common form. It is not possible to buy Acraloid/Paraloid B-72 as a stock solution, requiring the mixing of a batch prior to use. Try not to make more than a liter at the time, as it is not safe to store due to toluene's flammability. Acraloid/Paraloid B72 can only be purchased from conservation specialty suppliers (e.g., Conservation Materials, LTD., Sparks, Nevada). Application of the solution may be done by brush or immersion and drip drying. Adequate ventilation and protective clothing are essential, as toluene is both toxic and flammable. The use of toluene resistant gloves is mandatory as the liquid passes instantly through skin and attacks the fatty-tissues below. It may be necessary to use a vapor respirator. As before, if in doubt, contact a conservation professional for assistance.

Glass protected by Acraloid/Paraloid B-72 should be not be stored or displayed in direct sunlight, as it is possible to cause premature aging and yellowing of the protective film after 1200 hours of direct exposure. As a rule of thumb, no artifact should be displayed in strong direct sunlight. Aged films may be removed by careful and prolonged soaking in toluene baths, after which a new coat may be reapplied.

#### Glass: Conclusions

Glass artifacts are the most common artifact recovered by Licensed Sport Divers. If they are cared for and conserved the glass will provide many years of viewing and educational pleasure. There is no such thing as a "recipe book" of conservation techniques; proper conservation techniques must be tailored to the specific concerns and history of each individual artifact. Many of the conservation techniques used require specific training and safety precautions and should be left to the skill or guidance of professional conservators.

#### Conclusion

David Elkins' question concerning the conservation of glass was a great opportunity to start this column in the *Goody Bag*. Although many of the techniques require care and training, they can be safely done by Licensed Sport Divers with the appropriate guidance. Conservation workshops specifically designed to provide safe training in the techniques discussed in the "Conservation Corner" are planned for the near future. I look forward to receiving the next issue's question from you. So, stay informed and stay current, there's more to being a South Carolina Licensed Sport Diver than meets the eye!

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### SPORT DIVER PROGRAM MOVES TO CHARLESTON

The Sport Diver Archaeology Management Program (SDAMP) will be moving to Charleston in early May this year. The program will be moving from the main SCIAA office in Columbia to the SCIAA field office on the *NSS Savannah* at Patriots Point. This move has been requested by many hobby divers. The new location will make the program more accessible to the state's diving community. Most reported sites are also close to the coast, so it will enable us to respond more effectively to your calls. Hobby license applications and quarterly reports will then be processed by this office. The address will be: SCIAA Underwater Archaeology Field Office, 40 Patriots Point Rd., Mount Pleasant, Charleston, SC 29464 (803) 881-8536

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